

To: FAX NO. 00 4989 2399-4465  
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Mr. Ch. Tompouloglou,  
IPEA  
European Patent Office,  
D-80298 Munich,  
GERMANY.

25th July, 1997

Dear Mr. Tompouloglou,

International Application No. **PCT/GB 96/ 01773 - 2.1.13**  
International filing date: 24.07.1996  
Priority date: 26.07.1995

Further to official correspondence of 7.7.97, I enclose three copies of the revised claims.

Referring back to our telephone conversation of 19th June 1997, new claim 1 now encompasses features in original claims 1 to 3, in order to comply with the requirement of a distinguishing feature in claim 1. The other independent claim (new claim 11) has likewise been amended. The wording of the other claims has also been amended to clarify their respective characterising features.

Please do not hesitate to contact me on **0151 475 0047 (tel.)**, **0151 735 1447 (fax.)** if other changes are required.

We would like to thank the Examiner for the further opportunity given to revise the claims.

Yours faithfully,

ARLENE T. HALL

0901150 0911100

- Claims -

1. A device for filtering ferromagnetic material from a fluid in which said material is suspended, comprises a magnet and a pair of metal plates, said magnet having faces of opposite magnetic polarity, said plates being disposed in abutment with said faces respectively, each plate having a plurality of recesses about an outer perimeter of the plate to form radially extending magnetic pole pieces, which extend beyond an outer perimeter of the magnet faces, said plates being oriented so that the recesses and pole pieces on one plate are axially aligned with those recesses and pole pieces on the other plate, wherein axially opposite recesses define passage means for said fluid and also regions from which ferromagnetic material is repelled, and wherein said pole pieces define regions to which ferromagnetic material is attracted and retained, said device being further provided with a distribution plate having a plurality of apertures which are axially alignable with said recesses, said apertures being the only passage means of fluid to said metal plates, characterised in that the distribution plate, the magnet and said metal plates are each provided with an aperture which is adapted to receive a tube through which fluid can pass, said tube providing means for isolating, within the device, fluid passage in the tube from fluid flow through the recesses.

2. A device as in claim 1, characterised in that each recess and an outer edge of each pole piece is further provided with one or a plurality of slots.

3. A device as in claims 1 to 2, characterised in that the outer edges of axially facing pole pieces are curved towards one another.

4. A device as in claims 1 to 3, characterised in that means are provided for ensuring that said recesses and said apertures are maintained in axial alignment.

0901160-012093

5. A device as in claims 1 to 4, characterised in that the distribution plate is made of a non-ferromagnetic material.
6. A device as in claims 1 to 5, characterised in that the magnet is made of a material which will generate a magnetic field between the metal plates which is strong enough to attract ferromagnetic material from fluid passing therebetween.
7. A device as in claims 1 to 6, characterised in that the metal plate which is impinged first by fluid flow through the device, is thicker than the other metal plate through which fluid leaves the device.
8. A device as in claims 3 to 9, characterised in that an outer face of the tube is provided with a recess which can receive retaining means which is able to keep the distribution plate in abutment with the axially closer of said metal plates.
9. A device as in claims 1 to 8, characterised in that a housing is further provided, which is adapted at one end to be received by a containing means of said fluid, said containing means having an input means and an output means, the housing being adapted at the other end to receive a filter of known type, an output of which known filter is continuous with the tube in the magnetic filter device and also the input means to the containing means, said output means from the containing means being continuous with the apertures in the distribution plate and the recesses in the metal plates.
10. A device as in claim 1, characterised in that two distribution plates are disposed either side of each of the metal plates, each distribution plate having a plurality of apertures which are axially alignable with said recesses, said apertures being the only passage means of fluid to said metal plates, the apertures in both distribution plates providing inlet and outlet means for bi-directional axial flow of fluid.

11. A magnetic filter device for filtering ferromagnetic material from a fluid in which said material is suspended, comprises a known filter, a magnet and a pair of metal plates, said magnet having faces of opposite magnetic polarity, said plates being disposed in abutment with said faces respectively, each plate having a plurality of recesses about an outer perimeter of the plate to form radially extending magnetic pole pieces, which extend beyond an outer perimeter of the magnet faces, said plates being oriented so that the recesses and pole pieces on one plate are axially aligned with those recesses and pole pieces on the other plate, wherein axially opposite recesses define passage means for said fluid and also regions from which ferromagnetic material is repelled, and wherein said pole pieces define regions to which ferromagnetic material is attracted and retained, said known filter having passage means for said fluid which is continuous with fluid passage through said recesses, said device being further provided with a distribution plate having a plurality of apertures which are axially alignable with said recesses, said apertures being the only passage means of fluid to said metal plates, characterised in that the distribution plate, the magnet and said metal plates are each provided with an aperture which is adapted to receive a tube through which fluid can pass, said tube providing means for isolating, within the device, fluid passage in the tube from fluid flow through the recesses.

**PTO/PCT Rec'd 20 JAN 1998**

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European Patent Office  
Branch at The Hague  
BP 5818  
NL-2280 HV Rijswijk  
Netherlands

January 5, 1998

Dear Sirs,

**Re: PCT Application No. PCT/GB9601773**

Thank you for your fax of 11<sup>th</sup> December and other information sent by post.

Enclosed, please find, in triplicate, copies of replacement pages 1, 8, 9 & 10 for old pages 1, 8, 9 & 10, and additional page 1a to be inserted between new page 1 and old page 2.

We would greatly appreciate acknowledgement of receipt of the enclosed.  
Thank you for your kind attention.

Yours faithfully

J MARLOWE  
Applicant

Enc. Replacement pages 1, 8, 9 & 10; new page 1a (3 copies of each page)

0001150-04208

Rec'd PCT/PTO 20 JAN 1998

A MAGNETIC FILTER DEVICE

09/011160

- Description -

The present invention relates to a magnetic filter device for filtering ferromagnetic material from a fluid in which said material is suspended.

Fluid such as engine oil which circulates in an engine and/or gearbox, and hydraulic fluid which circulates in hydraulic systems, tends to accumulate ferrous material from metallic surfaces which are lubricated by the fluid. Such particulate material in suspension is liable to accelerate wear of these surfaces and thereby generate even more ferrous matter.

Conventional filters fail to filter out a substantial amount of ferrous material from the fluid, which material, is liable to cause damage to an engine and/or gearbox or hydraulic system. In addition, as there is no indication of the quantity of ferrous material in the fluid, the fluid conventionally, is changed after the engine or hydraulic system has been run for a certain period of time, in order to limit possible damage.

A magnetic filter device for filtering ferromagnetic material from a fluid in which said material is suspended, has an inlet means and an outlet means which are isolated from each other within the device. A pair of annular plates are attached to either side of an annular magnet of smaller diameter, which sides are of opposing magnetic polarity to thus generate a magnetic field between the pair of plates. Each plate is recessed to form radially extending pole pieces. The plates are oriented with respect to each other so that the pole pieces and recesses are axially aligned. The magnetic flux distributions thus created, divert ferromagnetic material in the fluid towards the regions defined by opposite pairs of pole pieces.

In use, the magnetic filter device can be inserted between a containing means or engine, and a conventional filter or pump, so as to enhance the collection of ferromagnetic material from the circulating fluid.

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- Claims -

1. A device for filtering ferromagnetic material from a fluid in which said material is suspended, comprises a magnet and a pair of metal plates, said magnet having faces of opposite magnetic polarity, said plates being disposed in abutment with said faces respectively, each plate having a plurality of recesses about an outer perimeter of the plate to form radially extending magnetic pole pieces, which extend beyond an outer perimeter of the magnet faces, said plates being oriented so that the recesses and pole pieces on one plate are axially aligned with those recesses and pole pieces on the other plate, wherein axially opposite recesses define passage means for said fluid and also regions from which ferromagnetic material is repelled, and wherein said pole pieces define regions to which ferromagnetic material is attracted and retained, said device being further provided with a distribution plate having a plurality of apertures which are axially alignable with said recesses, said apertures being the only passage means of fluid to said metal plates, characterised in that the distribution plate, the magnet and said metal plates are each provided with an aperture which is adapted to receive a tube through which fluid can pass, said tube providing means for isolating, within the device, fluid passage in the tube from fluid flow through the recesses.

2. A device as in claim 1, characterised in that each recess and an outer edge of each pole piece is further provided with one or a plurality of slots.

3. A device as in claims 1 to 2, characterised in that the outer edges of axially facing pole pieces are curved towards one another.

4. A device as in claims 1 to 3, characterised in that means are provided for ensuring that said recesses and said apertures are maintained in axial alignment.

AMENDED SHEET

5. A device as in claims 1 to 4, characterised in that the distribution plate is made of a non-ferromagnetic material.

6. A device as in claims 1 to 5, characterised in that the magnet is made of a material which will generate a magnetic field between the metal plates which is strong enough to attract ferromagnetic material from fluid passing therebetween.

7. A device as in claims 1 to 6, characterised in that the metal plate which is impinged first by fluid flow through the device, is thicker than the other metal plate through which fluid leaves the device.

8. A device as in claims 3 to 9, characterised in that an outer face of the tube is provided with a recess which can receive retaining means which is able to keep the distribution plate in abutment with the axially closer of said metal plates.

9. A device as in claims 1 to 8, characterised in that a housing is further provided, which is adapted at one end to be received by a containing means of said fluid, said containing means having an input means and an output means, the housing being adapted at the other end to receive a filter of known type, an output of which known filter is continuous with the tube in the magnetic filter device and also the input means to the containing means, said output means from the containing means being continuous with the apertures in the distribution plate and the recesses in the metal plates.

10. A device as in claim 1, characterised in that two distribution plates are disposed either side of each of the metal plates, each distribution plate having a plurality of apertures which are axially alignable with said recesses, said apertures being the only passage means of fluid to said metal plates, the apertures in both distribution plates providing inlet and outlet means for bi-directional axial flow of fluid.

AMENDED SHEET



11. A magnetic filter device for filtering ferromagnetic material from a fluid in which said material is suspended, comprises a known filter, a magnet and a pair of metal plates, said magnet having faces of opposite magnetic polarity, said plates being disposed in abutment with said faces respectively, each plate having a plurality of recesses about an outer perimeter of the plate to form radially extending magnetic pole pieces, which extend beyond an outer perimeter of the magnet faces, said plates being oriented so that the recesses and pole pieces on one plate are axially aligned with those recesses and pole pieces on the other plate, wherein axially opposite recesses define passage means for said fluid and also regions from which ferromagnetic material is repelled, and wherein said pole pieces define regions to which ferromagnetic material is attracted and retained, said known filter having passage means for said fluid which is continuous with fluid passage through said recesses, said device being further provided with a distribution plate having a plurality of apertures which are axially alignable with said recesses, said apertures being the only passage means of fluid to said metal plates, characterised in that the distribution plate, the magnet and said metal plates are each provided with an aperture which is adapted to receive a tube through which fluid can pass, said tube providing means for isolating, within the device, fluid passage in the tube from fluid flow through the recesses.

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AMENDED SHEET

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UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office  
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OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY DOCKET NO.
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EXAMINER

ART UNIT

PAPER NUMBER

DATE MAILED:

**NOTICE OF INSUFFICIENT FILING FEES**

APPLICANT IS GIVEN 30 DAYS FROM THE DATE OF MAILING OF THIS NOTICE WITHIN WHICH TO SUBMIT THE BALANCE DUE. Extension of this 30 day period under 37 CFR 1.136(a) will not be permitted. Failure to respond within this period will result in the application becoming abandoned. 35 U.S.C. 133.

The filing fees submitted in connection with this application are insufficient. See the attached Patent Application Fee Determination Record (Form PTO-875). The balance due for additional claims and/or multiple dependent claims is summarized below:

☒ A. Filing Fees due upon filing the application

Total Filing Fees Due	= \$	600.00
Less Filing Fees Submitted	- \$	(595)
<b>BALANCE DUE</b>	= \$	5.00

☐ B. Fees due in connection with the amendment filed on \_\_\_\_\_

Total Fees Due	= \$	_____
Less Fees Submitted	- \$	( )
<b>BALANCE DUE</b>	= \$	_____

\_\_\_\_\_  
Clerk of Group

ATTACHMENT: FORM PTO-875

APPLICANT: PLEASE COMPLETE THIS PORTION AND RETURN THIS NOTICE WITH PAYMENT

Fee submitted \$ \_\_\_\_\_ Signature \_\_\_\_\_

**CERTIFICATE OF MAILING**

I hereby certify that this notice and the required additional fee are being deposited with the U.S. POSTAL SERVICE as first class mail in an envelope addressed to:  
Commissioner of Patents and Trademarks, Washington, D.C. 20231, on (date) \_\_\_\_\_

Print Name: \_\_\_\_\_ Signature: \_\_\_\_\_